were used to develop generalized skew relations. The second set of standard analyses was done using station skews weighted with generalized skews from the new skew relations. One set of standard analyses, using station skews only, was done for stations on regulated streams. Adjustments were made to peak-flow frequency analyses, as appropriate, for historic data and high and low outliers. Experience of the authors showed that the statistical tests for low outliers included in Bulletin 17B were not well suited for detecting multiple outliers. Therefore, adaptations of the existing procedure, other tests, and considerable judgment were used to identify and censor low outliers in these situations.

Regional equations relating generalized skew coefficients to basin characteristics were developed for most of the state, and a statewide map of generalized skew coefficients for basins with relatively low average permeability also was developed. Station skew coefficients were computed for stations in or within about 50 miles of Nebraska that, generally, had 25 years or more of unregulated peak flows. Several stations with as few as 18 peak flows were used where data were lacking. After other adjustments had been made, stations with identified high outliers were analyzed further to estimate how sensitive the station skew coefficients were to the high outliers. As a result, some stations were eliminated from further consideration in the development of skew relations.

An equation to estimate skew was developed first for basins with average permeability of the 60-inch soil profile (*P60*) of more than 2.5 inches per hour. A skew map of the state then was developed for basins with *P60* less than 4 inches per hour, except for the Elkhorn River Basin where all basins were included. Regional equations, based on geographic areas, also were developed; those with mean-square errors (MSEs) less than those for the new skew map were adopted. The standard error of estimate (SEE) of the statewide skew map is 0.24. This compares to 0.78 for the Nebraska part of the National skew map and to 0.59 for the map developed by Cordes (1993), both of which include the high-permeability sandhills areas. SEEs for the skew equations ranged from 0.13 to 0.23. The equations were developed using multiple-regression analyses; residuals from the analyses were used to define regions and to determine the best combination of explanatory variables that were reasonable hydrologically.

An alternative set of peak-flow frequency analyses were computed for selected stations using a conditional probability method suggested by William Kirby (USGS). Peak-flow frequency curves for most of the high-permeability stations appeared to indicate a pattern of different characteristics for the larger peak flows. Because of the relatively high permeabilities and large amounts of noncontributing drainage area in typical sandhills terrain, it was theorized that most of the smaller peak flows primarily were interflow and baseflow and that the larger peak-flows included a significantly greater proportion of surface runoff. Plots of peak flow compared to the 1- or 2-day lag of daily flow for several stations appeared to indicate that the theory was plausible.

Other types of mixed populations in peak-flow data also were apparent, including partially regulated stations and low-permeability stations that were usually from the more arid parts of the state. Composite analyses were done for several of these stations; however, the thorough investigations required to justify and split the data, and actually do composite analyses for all of these other stations were beyond the scope of this study. Instead, peak-flow frequencies for partially regulated sites were computed using only station skews, and low-permeability stations were excluded from the regional analyses of peak-flow frequency.

Peak-flow frequency relations were developed for standard probabilities of 50, 20, 10, 4, 2, 1, 0.5, and 0.2 percent or for frequencies of 2, 5, 10, 25, 50, 100, 200, and 500 years, respectively. Streamflow-gaging stations with peak flows that are known to have been or that could have been affected to some degree by regulation (flood control, irrigation diversions, power generation, storage detention, or other factors) were excluded from regional peak-flow frequency analyses. Preliminary regional equations were developed and regions were defined using ordinary least squares (OLS) multiple-regression procedures. Final regression equations were developed using a GLS multiple-regression procedure. The GLS procedure adjusts for differences in record lengths, differences in peak-flow variances, and cross-correlations of concurrent peak flows among stations used in the regression analysis.

For unregulated streams, eight sets of regression equations relating drainage-basin characteristics to peak flows for selected frequencies of occurrence were developed for seven regions of the state. Two sets of regional peak-flow frequency equations were developed for a high-permeability region that includes basins with *P60* greater than 4 inches per hour. Six sets of equations were developed for specific geographic areas, usually based on drainage-basin boundaries. Of the two sets of high-permeability equations, one set was developed using data from standard frequency analyses and the other was developed using data from composite frequency analyses. In general, these two sets of equations are for drainage basins with sandhills-type terrain. The six hydrologic regions based on geography were delineated using residual values and plots from preliminary regression analyses. There is overlap between several of the regions where more than one equation can be used to estimate peak flows.

Tables for each region include the equations, the SEE in $\log_{10}$ units and in percent, the average standard error of prediction (SEP) in $\log_{10}$ units, the average equivalent years of record for each equation, and the applicable range of the explanatory variables used to develop the equations. SEEs for the 100-year recurrence interval equations ranged from 12.1 to 63.8 percent.

For streamflow-gaging stations on regulated streams in Nebraska with at least 10 years of regulated peak flows, peak-flow frequency analyses were done using the LP3 distribution and the guidelines in Bulletin 17B of the Interagency Advisory Committee on Water Data. Skew coefficients used were those derived only from each station’s peak-flow data. Peak-flow records within the period of the current regulated condition were used for the station analyses. For nine streams that included more than one station with at least 25 years of regulated record, graphs of peak-flow frequency and distance upstream of the mouth were estimated. Log-linear graphs were developed for the Niobrara, North Platte, South Platte, Platte, and Republican Rivers, and for Salt, Antelope, Frenchman, and Red Willow Creeks.

For the regional peak-flow frequency equations for unregulated streams, statistical analyses were done to estimate how additional years of peak-flow data might affect the ASEs of the equations for the 100-year frequency of occurrence. For each regional equation, analyses were done for four different scenarios—10 and 20 years of additional record from the stations used to develop the equation; and 10 and 20 years of additional record from new stations as well as from the stations used to develop the equation.

Various scenarios and regions can be compared to determine where the greatest overall benefits might be gained for the least amount of new data and hence for the least cost. For each scenario, plots of ASE and number of stations in the network were presented. Based on the results, data from new stations, rather than more data from stations used to develop the regional peak-flow frequency equations, probably would most reduce the ASE of the equations.

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